

Dynamical Adaptation in ORNs

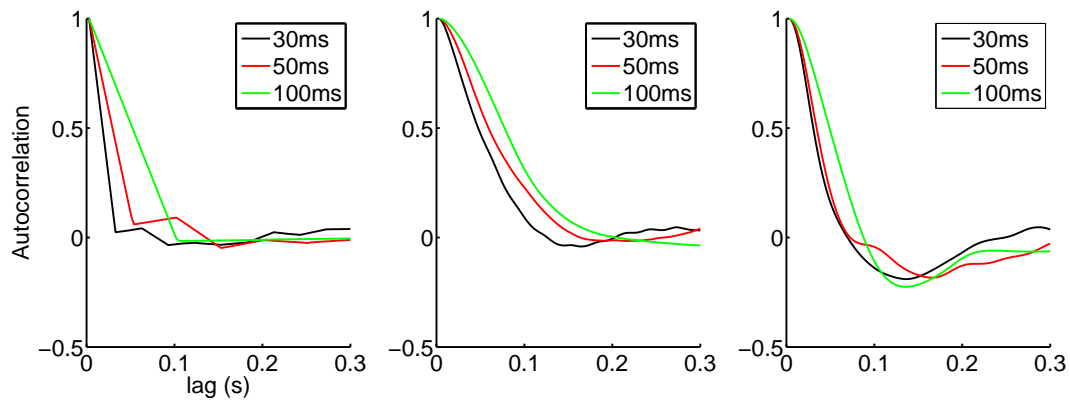
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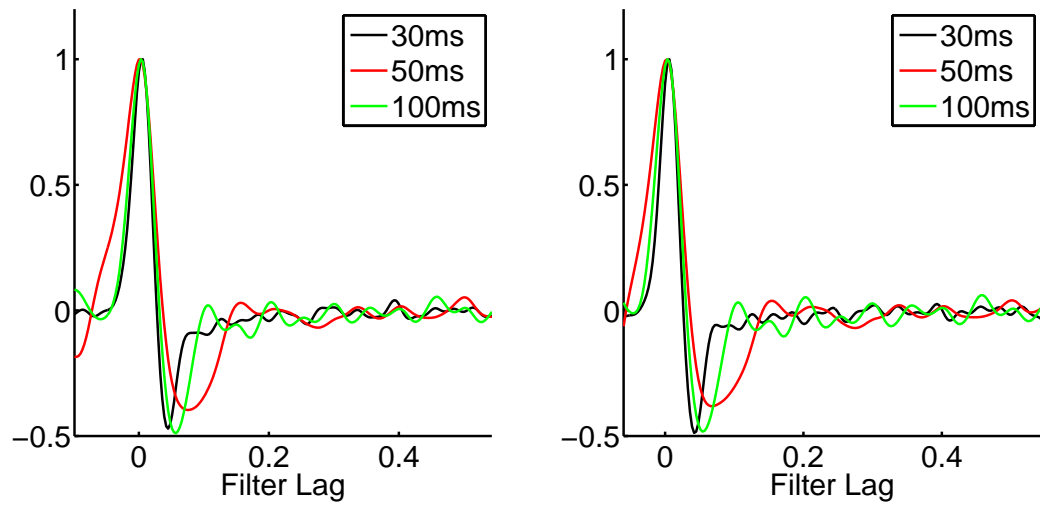
Effect of Correlation Time on Linear Filters

What is the effect of correlation time of the stimulus on the ORN response, and the filter that we calculate from this data?

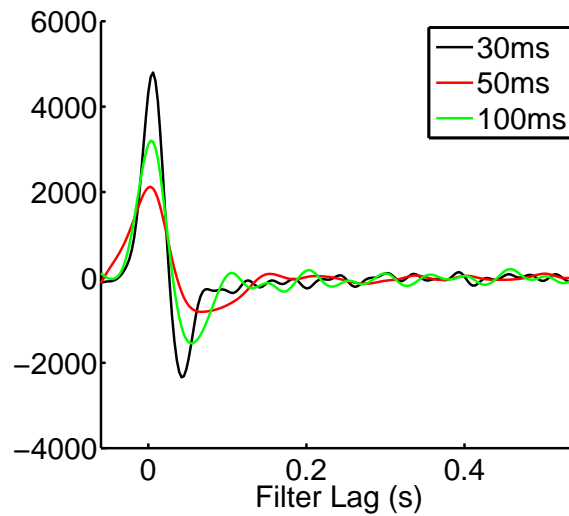
First, we plot the autocorrelation functions of the valve, the stimulus and the ORN and check that they make sense.



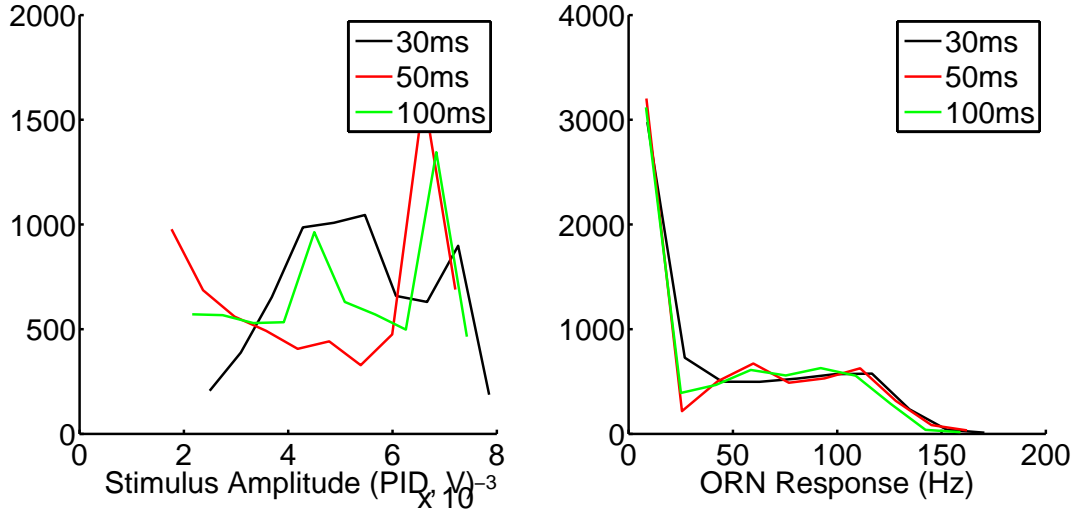
Now we fit filters to these data sets. In the figure below, the filters on the left are calculated using a fixed regularisation (of 1), and the filters on the right, the regularisation is varied in each case to find the "best" filter, minimising errors, high frequency components, and having a gain as close to unity as possible. In either case, we see the filters are slightly different for the three data sets; the correlation time of the stimulus seems to affect the filter we extract.



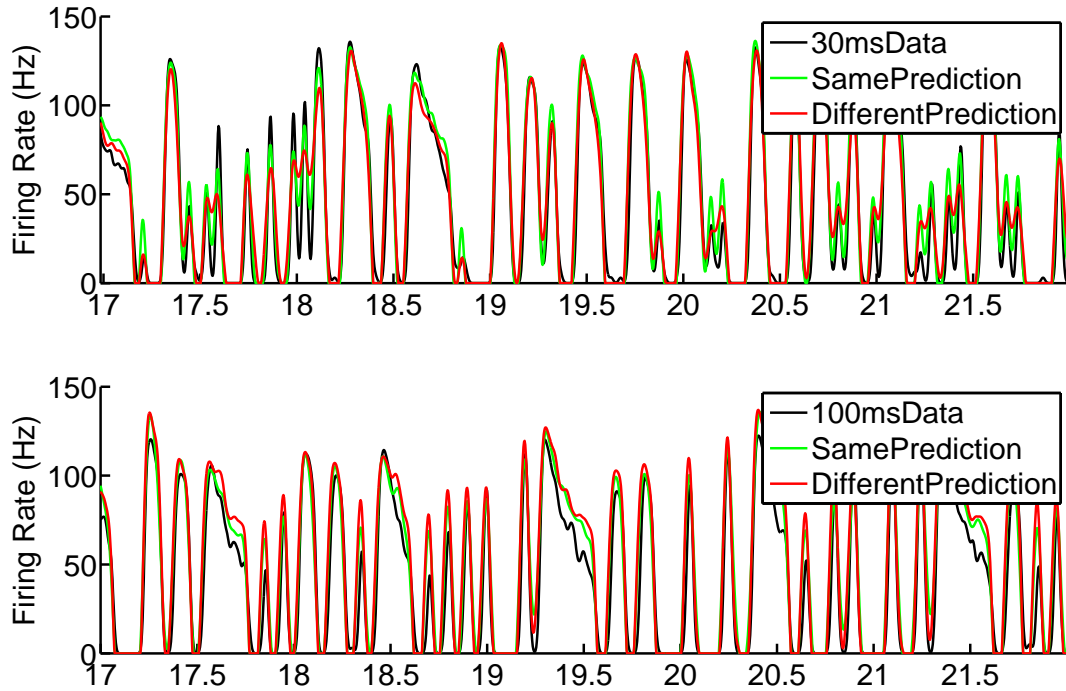
These filters differ not only in their shape but also their amplitude, which is a simple scaling because the input statistics are different.



Why does the filter amplitude change so much? let's look at the stimulus and the response histograms:



How good are these filters at estimating the data? In the figure we below, we show the two extreme cases (the 30ms and 100ms correlated data) and the predictions from the filters calculated from their own data sets, along with predictions from filters calculated using the others' data. The cross-prediction filters are re-scaled by the amplitude of the self-prediction filters, so all differences in prediction are due to filter *shape* and not due to filter *amplitude*



How good are these cross-predictions? For the three data sets we have, we measure how well the filter

from each data set predicts the data. In the matrix below, the element in i th row and j th column shows the r -square of linear prediction by the i th filter to j th data set, where the first data set has 30ms correlated stimulus, the second has 50ms correlated stimulus, and the 3rd has 100ms correlated stimulus.

0.9344	0.9273	0.9155
0.8365	0.9486	0.8939
0.9137	0.9363	0.9397

In particular, predictions using the fastest filter outperform predictions even from filters from the same data set.